WHAT IS CLAIMED IS:

1. A planar MRI system having an open magnet configuration that produces a magnetic field having a remote region of substantial magnetic field homogeneity, spatial encoding gradient coils and a rf coil, the open magnet configuration comprising:

a ferromagnetic core having a substantially planar core surface layer and a longitudinal axis; and

a unipolar current wire pair on a side of the ferromagnetic core adjacent said planar core surface layer, the wire pair being separated along said longitudinal axis and extending in a direction substantially perpendicular to the axis and substantially parallel to the planar core surface layer,

the current wire pair providing a magnetic field having a maximum between the current wire pair along a direction perpendicular to said planar core surface layer and in said remote region of substantial magnetic field homogeneity,

the planar core surface layer of the ferromagnetic core providing an orthogonal refractory effect that substantially increases the resulting magnetic field compared to a magnetic field generated by the current wire pair in free space.

2. The MRI system of claim 1, wherein the ferromagnetic core comprises a plurality of layers of ferromagnetic material including said planar core surface layer, which is adjacent said current wire pair, said magnet configuration being constructed and adapted such that the core surface layer

operates near a magnetic saturation value of the ferromagnetic material forming the core surface layer.

3. The MRI system of claim 2, wherein the core surface layer comprises a ferromagnetic material having a magnetic property including a H_{sat} value and the core surface layer operates within about 20% of the H_{sat} value.

4. The MRI system of claim 2, wherein the core surface layer comprises a ferromagnetic material having a magnetic property including a H_{sat} value and the core surface layer operates within about 10% of the H_{sat} value.

5. The MRI system of claim 2, wherein the core surface layer comprises a ferromagnetic material having a magnetic property including a H_{sat} value and the core surface layer operates within about 5% of the H_{sat} value.

6. The MRI system of claim 2, wherein the core surface layer comprises a first ferromagnetic material and at least one of the layers comprises a second ferromagnetic material, wherein the first ferromagnetic material has a higher saturation induction and permeability than the second ferromagnetic material.

7. The MRI system of claim 1, further comprising a ferromagnetic end extension extending from the plane of planar core surface layer, the end extension being positioned adjacent to a wire of and longitudinally exterior of the current wire pair.

8. The MRI system of claim 7, wherein the ferromagnetic end extension comprises a plurality of layers of ferromagnetic material including an end extension surface layer that is adjacent a wire of said current wire pair, said magnet configuration being constructed and adapted such that the end extension surface layer operates near a magnetic saturation value of the ferromagnetic material forming the end plate surface layer.

9. The MRI system of claim 8, wherein the end extension surface layer comprises a ferromagnetic material having a magnetic property including a H_{sat} value and the end extension surface layer operates within about 20% of the H_{sat} value.

10. The MRI system of claim 8, wherein the end extension surface layer comprises a ferromagnetic material having a magnetic property including a H_{sat} value and the end extension surface layer operates within about 10% of the H_{sat} value.

11. The MRI system of claim 8, wherein the end extension surface layer comprises a ferromagnetic material having a magnetic property including a H_{sat} value and the end extension surface layer operates within about 5% of the H_{sat} value.

12. The MRI system of claim 7, wherein the end extension surface layer comprises a first ferromagnetic material and at least one of the layers

comprises a second ferromagnetic material, wherein the first ferromagnetic material has a higher saturation and permeability than the second ferromagnetic material.

13. The MRI system of claim 7, wherein the ferromagnetic end plate extends perpendicular to the ferromagnetic core.

14. The MRI system of claim 7, wherein the ferromagnetic end plate extends at an acute angle from the perpendicular to the planar core surface layer and in a direction toward the current wire pair.

15. The MRI system of claim 14, wherein said angle is between 0 and about 20°.

16. The MRI system of claim 1, further comprising a shimming current wire pair located on a side of the ferromagnetic core closest to said planar core surface layer.

17. The MRI system of claim 16, further comprising a ferromagnetic shimming core having a planar shimming core surface layer adjacent to .said shimming current wire pair.

18. An MRI system having an open back to back magnet configuration that produces two independent magnetic fields, each having a remote region of substantial magnetic field homogeneity, the system comprising spatial encoding

gradient coils and a rf coil for each remote region, the open magnet configuration comprising:

a ferromagnetic core having a longitudinal axis, a first and a second side, each side having substantially planar core surface layer; and

a unipolar current wire pair on each side of the ferromagnetic core adjacent said planar core surface layer, the wire pair being separated along said longitudinal axis and extending in a direction substantially perpendicular to the axis and substantially parallel to the planar core surface layer, wherein said unipolar current wire pair on each side of the ferromagnetic core are provided by a pair of current loops wound around the ferromagnetic core;

each current wire pair providing a magnetic field having a maximum between the current wire pair along a direction perpendicular to said planar core surface layer and in said remote region of substantial magnetic field homogeneity,

the planar core surface layer of the ferromagnetic core adjacent each current wire pair providing an orthogonal refractory effect that substantially increases the resulting magnetic field compared to a magnetic field generated by the current wire pair in free space.

19. A MRI system having two face to face open magnet configurations that each produce a magnetic field having a remote region of substantial magnetic field homogeneity, spatial encoding gradient coils and a rf coil, wherein a first and a second open magnet configuration each comprise:

a ferromagnetic core having a substantially planar core surface layer and a longitudinal axis; and

a unipolar current wire pair on a side of the ferromagnetic core adjacent said planar core surface layer, the wire pair being separated along said longitudinal axis and extending in a direction substantially perpendicular to the axis and substantially parallel to the planar core surface layer,

the current wire pair providing a magnetic field having a maximum between the current wire pair along a direction perpendicular to said planar core surface layer and in said remote region of substantial magnetic field homogeneity,

the planar core surface layer of the ferromagnetic core providing an orthogonal refractory effect that substantially increases the resulting magnetic field compared to a magnetic field generated by the current wire pair in free space,

wherein the remote region of substantial magnetic field homogeneity provided by a first open magnet configuration overlaps the remote region of substantial magnetic field homogeneity provided by a second open magnet configuration, thereby providing a total magnetic field equal to the sum of the remote regions provided by the first and the second open magnet configurations.